Automatic Battery Switchover

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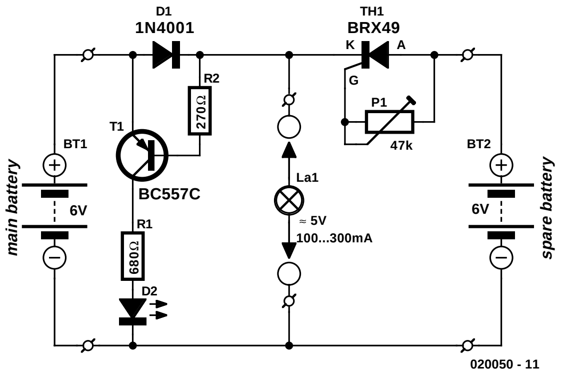
K.-H. Lorenz

This circuit, which is designed for use with 6-V rechargeable batteries, provides automatic switchover to a reserve battery when the voltage of the main battery approaches the fully discharged level. The clever thing about this circuit is that the actual switchover is voltage-dependent and adjustable, even though the circuit essentially consists of only two components. The active element is a small thyristor (type BRX49), which is connected between the load and the reserve battery. For calibrating the switchover point, an incandescent lamp is connected as a load. In actual use, however, the load can be anything having a maximum current consumption of 300 mA at around 5 V.

The cathode of the thyristor is connected to the load, with the anode connected to the positive terminal of the reserve battery. The gate of the thyristor is also connected to the positive terminal of the reserve battery via a 47-kΩ trimpot (P1). This already clearly suggests how the automatic switchover works.

The voltage across the thyristor is the difference between the two battery voltages. Initially, with both batteries fully charged, the voltages of the two batteries are nearly the same. The thyristor is thus cut off, since there is not any significant voltage across it and no gate current flows via P1. As the main battery becomes increasingly discharged, the voltage across the load decreases, which means that the voltage at the cathode of the thyristor decreases. The anode thus becomes positive with respect to the cathode and the gate. A gate current starts to flow via P1, with its magnitude depending on the voltage and the value of P1. As soon as the gate current exceeds the triggering threshold of the thyristor, the thyristor fires (which means that it suddenly starts to conduct), causing the reserve battery to be connected to the load. Since the voltage of the reserve battery is higher than that of the discharged main battery, diode D1 is cut off, preventing any current from flowing from the reserve battery into the main battery. We thus have a circuit that indeed switches from the main battery to the reserve battery.



Diode D1 not only prevents a reverse current flow from the reserve battery into the main battery, it also forms part of an indicator circuit, in combination with transistor T1 and LED D2. This circuit works as follows: as long as a current flows from the main battery through D1, a base current also flows through the base–emitter junction of the transistor, which together with the base resistor R1 is connected in parallel with D1. This causes the transistor to conduct, so LED D2 is illuminated to indicate that the main battery is in use. When the circuit switches over to the reserve battery, T1 is also cut off, and the LED is immediately extinguished.

To calibrate the circuit, connect only the reserve battery to the circuit (a non-rechargeable battery can also be used), and replace the main battery by an adjustable power supply whose output voltage can be varied over (at least) the range of 5 V to 8 V. After first setting P1 to maximum resistance, adjust the power supply voltage to match the voltage of the reserve battery. After it is connected to the circuit, the LED will illuminate.

Now slowly reduce the power supply voltage to approximately 5.3 V, and then slowly rotate the trimpot until the switchover occurs, which can be recognised by the LED going out. Next, increase the power supply voltage and then reduce it again, in order to verify the operation of the circuit.

If necessary, the setting of the trimpot should be readjusted until switchover occurs reliably when the desired voltage is present at the main battery terminal.

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